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Study on Cost Control of Construction Enterprises in the Context of the COVID-19 - A Case Study of China Construction

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Abstract: Coming into the post-pandemic, the influences that this COVID-19 had on the construction and built environment create a less of cost to be used in managing the captured events. The following research project is designed to evaluate how the outbreak of the coronavirus epidemic has affected cost management behavior within enterprises in the field of construction including construction within the China economy. Through a synergetic approach, the grey correlation model and the value engineering method have been combined giving a financial cost control model that can vouch for the challenges appearing in the post-pandemic business context. The data on timeline change and expense allocation in accommodation related adjusted processes, in turn, models the new routines of work for the industry. The results of my research make it clear that various changes need to be implemented mostly in cost management practices. This help in improving resilience and risk minimization is the most important.

Keywords: COVID-19, Cost Control, Construction Cost

1. Introduction

The construction industry faced considerably large challenges because of COVID-19 with both direct and indirect adverse effects due to lockdowns. This study focuses on investigating cost management of construction, with specific reference China State Construction Engineering Corporation's approach to the various points of the building life cycle. The pandemic brought disruption to the supply chains in factories while the others were adhering to safety regulations and endeavoring to keep cost under control [1].

Such ancillary costs with greater delays lead to the searching and implementation of new financial measures. According to research, increased cost can arise from safety equipment [2] and works are disrupted due to the stress of schedules [3]. The fact that challenges can lead to more central cost and delay shipment platforms has been understood by studies carried out by Berger et al.[4] and by Ivanov [5].

This work compliments the grey correlation and value engineering models that help in cost management. Effort is on a tunneling of vital MBIs to vacant [6], and free of the deficit spending

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[7].A case of China Construction provides an example of a pro-active financial strategies by the company during crises.

Literature as a matter of fact brings a number of different perspectives on addressing construction costs in crises. Differentiated in use of technology, Getachew et al. [8] prove to be the obvious choice to fight against the pandemic. Whereas Wang et al. [9] and Zhao et al. [10] bring in relevance of electronic and remote means of control. As well as ensuring that the application of adaptive program management strategies, as finalizing timelines and allocating the resources, is also important [11].

The report concludes by the summarization of the findings so that a wide-ranging perspective on cost containment during crises may be established. The study therefore gives a number of hands-on recommendations for construction firms and serves as an example for other firms to grow their resilience [12].

2. The impact of COVID-19 on project costs for China construction companies

2.1. Changes in schedule of real estate projects and anti-epidemic projects

The study selects four representative projects, namely the Huoshenshan Hospital Project, the North Lantau Hospital Hong Kong Infection Control Centre Project, the Beijing Daji Dangerous Building Renovation Project, and the China Construction Jinxiu Capital Project.

Table 1: *Project Duration Change Table* (Source: China Construction Annual Reports)

Project	Start Date	Estimated Completion Date in 2018 Annual Report	Estimated Completion Date in 2020/2021 Annual Report
Huoshenshan Hospital	January 2020	-	February 2020
North Lantau Hospital Hong Kong Infection Control Center	October 2020	-	January 2021
Beijing Daji Reconstruction Project	January 2003	December 2021	December 2025
Zhongjian Jinxiu Capital	August 2018	December 2021	December 2024

2.2. Some projects under construction are behind schedule

The following is the progress of important projects of China Construction:

DOI: 10.54254/2754-1169/93/20241075

Table 2: *Progress of major construction projects in China in 2021* (Source: China Construction Annual Reports)

	Project Progress	Interest Capitalization Accumulated Amount	This Year Interest Capitalization	Interest This Year Capitalization rate (%)
China Construction Third Engineering Bureau Beijing Headquarters Base Office Building Project	100%	209,501	22,084	5.78
China Construction Jinxiu Tiandi Construction Project	100%	135,000	19,730	4.50
Songjiang Yunzhu in Deep Blue Construction Project	99%	6,716	413	4.75
Others	Not Applicable	99,234	39,851	Not Applicable

Table 3: *Progress of Major Construction Projects in China in 2020* (Source: China Construction Annual Reports)

	Project Progress	Interest Capitalization Accumulated Amount	This Year Interest Capitalization	Interest This Year Capitalization rate (%)
China Construction Third Engineering Bureau Beijing Headquarters Base Office Building Project	89%	187,417	63,556	5.78
China Construction Jinxiu Tiandi Construction Project	69%	115,270	43,455	4.50
Songjiang Yunzhu in Deep Blue Construction Project	96%	6,303	2,718	4.75
Others	Not Applicable	59,383	29,282	Not Applicable

The Songjiang Yunzhu Deep Blue construction project originally planned to be completed in 2020 was 96% completed at the end of 2020, and 99% completed at the end of 2021. Not completed as planned. The following uses the earned value method to analyze its project progress.

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2.3. Evaluating Construction Time and Cost Using the Earned Value Method

Table 4: *Earned Value Analysis* (Source: China Construction Annual Reports)

Item	Content
Estimated Cost of Work to be Performed	The budgeted cost of work performance (BCWP) for the Songjiang Yunzhu Deep Blue construction project is 360,000 yuan for 69,289.28m², with 96% completed in 2020. BCWP = Completed work × Budgeted unit cost. Estimated value in 2020: 345,891,000 yuan.
Budgeted Costs of Planned Projects	The budgeted cost of scheduled work (BCWS) is 360,000 yuan for the Songjiang Yunzhu Deep Blue project to be completed by September 2020. BCWS = Planned workload × Budgeted unit cost. Estimated cost: 360,000 thousand yuan.
Actual Cost of Completed Work	The actual cost of work performed (ACWP) for the Songjiang Yunzhu Deep Blue project by December 2020 is 367,836.48 thousand yuan for 66,517.7m². ACWP = Completed work × Actual unit cost. Actual cost: 367,836.48 thousand yuan.
Cost Variance	Cost Variance (CV) = BCWP - ACWP. For the China Construction Jinxiu Tiandi project: BCWP = 345,891,000 yuan, ACWP = 367,836.48 thousand yuan, CV = -21,945 thousand yuan (over budget).
Schedule Deviation	Schedule deviation (PS) = BCWP - BCWS. For the China Construction Jinxiu Tiandi project: BCWP = 345,891 thousand yuan, BCWS = 360,000 thousand yuan, PS = -14,109 thousand yuan (behind schedule).

The following is a summary table of earned value method indicator evaluation data:

Table 5: *Earned Value Method Indicator Evaluation Data Table* (Source: China Construction Annual Reports)

Index	Number
BCWP	345,891
BCWS	360,000
ACWP	367,836
CV	-21,945
PS	-14,169

3. Grey relational static evaluation model

3.1. Selection of evaluation indicators

Since the factors affecting cost are mainly construction period, construction organizational structure and unpredictable factors (including price and manpower) [13], the change amount of projects under construction, the cost of important raw materials, and employee wages and personnel expenses are used as evaluation indicators.

The following are the selected parent indicators and evaluation indicator values:

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Table 6: *Parent indicators and evaluation index v*alues (Source: China Construction Annual Reports)

Year	Cost	Changes in construction in progress	Cost of important raw materials	Employee salaries and personnel expenses
2019	1,262,226,200	5,408,977	365,217,797	64,378,787
2020	1,440,131,634	5,054,101	371,054,984	77,421,854
2021	1,677,136,509	6,675,256	408,088,395	85,716,394

3.2. Calculation of grey correlation coefficient

The following is the correlation coefficient result graph:

Table 7: *Correlation Coefficient Result Graph*

	Changes in Construction in Progress	Important Raw Material Costs	Employee Compensation and Personnel Expenses
2019	0.8280111900471137	1	0.8520278099733023
2020	0.7629973148145222	0.9096426038363667	0.7881191975802553
2021	0.6913216440026381	0.8231984651845129	0.713839449524261

3.3. Calculation of grey relational value

The following is the correlation result graph:

Table 8: *Correlation Result Graph*

Evaluation Items	Correlation	Ranking
Important Raw Material Costs	0.911	1
Employee Compensation and Personnel Expenses	0.785	2
Changes in Construction in Progress	0.761	3

4. Conclusion and Discussion

The post-pandemic period has construction sector with new approaches to cost control related to the modified operation environment. Reducing construction periods of non-epidemic projects is an effective means to reduce costs for construction, especially in the real estate sector.

Project times in China's pursuit of real estate could often prolong to a time that is beyond the limit with acceptable scope. Tracking progress and re-scheduling, as part of 'plan-do-check-act', provide critical foundation to cost-effectiveness analysis. Program scheduling must be set up to prevent these problems from arising.

Being knowledgeable about the local downtimes as well as the production systems is one of the cost-efficient systems. Inaccuracies can be the reason for postponing projects and added expenditures for the contractor. Smart management emphasizes proactive change that match with the policy updates and performance results.

Smart management of resources, especially the workforce, optimization derives higher output and on-time completion. The effects of the pandemic have been to slow projects and to increase costs.

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Some workers deploying the efficiency of the workers while the subcontractor's reliability are other key factors for experience delays and costs.

Implementing mature technologies means the activities will be ensured a high-performance level during uncertainty. The correct resource management is the powerful indicator of the success. Energy management and specialized sourcing strategies are the keys to realizing the budget cutting effectiveness.

The pandemic has propelled the construction sector to address efficiency, cutting costs, and anticipation to develop the capacity in the post-pandemic world.

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